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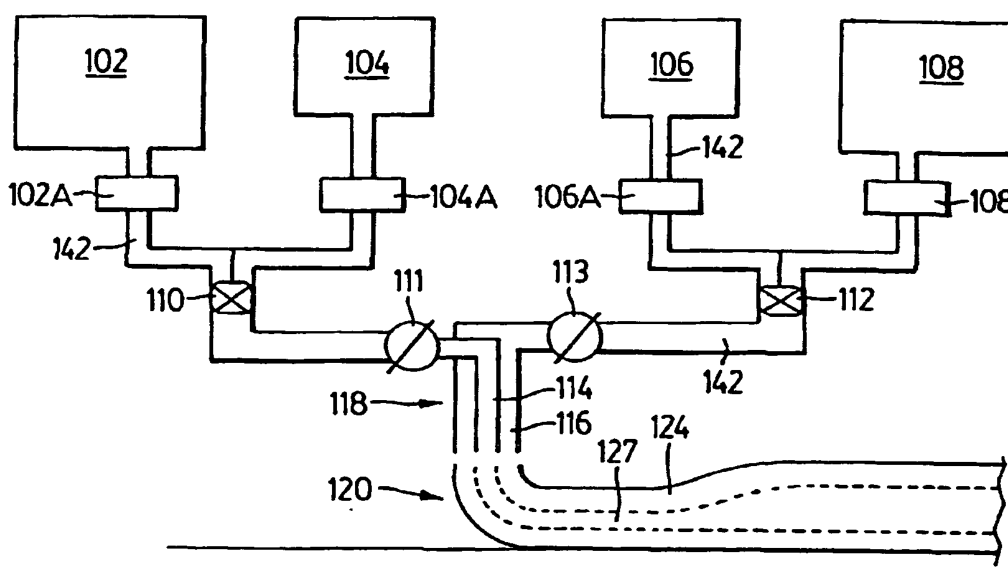
(54) Title: GASKET, METHOD OF MANUFACTURING AND APPARATUS FOR MANUFACTURING SAME



(57) Abstract: A gasket (1) has a gasket core (2) and an outer gasket layer (4) covering the gasket core (2). At least one of the two sealing materials that make up the gasket has two reactive components before they are extruded, with said components chemically reatcting with one another as they are combined and/or extruded. The extruded core may be formed of a two-component resin which is at least one of an elastomer and a foam. The flexible outer layer may be a synthetic resin which is at least one of an elastomer and a foam. The outer layer may be electrically conductive, ultra-violet resistant, or resistant to the environment in which the gasket is to operate. Also taught are methods of apparatus for the manufacture of such gaskets

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TITLE

Gasket, Method of Manufacturing and Apparatus for Manufacturing Same

FIELD OF THE INVENTION

This invention relates to gaskets, their manufacture and apparatus for manufacturing same.

BACKGROUND OF INVENTION

There are many applications in which outer surface layers of a gasket and an inner core of the gasket require different and possibly mutually inconsistent properties, and thus proposals have been made for gaskets formed with an outer layer and an inner core of different materials.

For example, the prior art describes the production of prefabricated gaskets for electromagnetic shielding consisting of an inner core and an outer layer. The inner core provides the gasket with physical properties such as compression deflection, tensile strength and elongation. The outer layer provides the surface with properties such as electrical conductivity. Both the inner core and the outer layer are elastomeric. The two layers can be co-dispensed (US 4,968,854) or the inner core can be formed first with the outer layer applied afterwards (US 5,141,770). The inner core usually consists of a one-component thermoplastic resin or a one-component, heat-cured extruded rubber. The outer layer is also a one-component thermoplastic resin or a one-component, heat-cured extruded rubber. The outer component can also be made from a low-viscosity coating dispersion containing an elastomeric binder, a metallic material, a curing agent and a diluent, such as an organic solvent. The solvent is used to substantially reduce the viscosity of the coating, the inner core being in this case extruded and solidified prior to the application of the coating.

Gaskets may be used for electromagnetic shielding of electronic casings, and in the course of increasing miniaturization of casings, are placed in a free-flowing state from a nozzle directly onto a casing section to be sealed, where they harden. For the electromagnetic shielding of casings, the outer gasket layer usually consists of a sealing material that is a good conductor of electricity, while the inner layer, or an inner gasket core, is usually made of a sealing material that is a poor conductor of electricity or does not conduct electricity at

all. Such a seal combines the good electrical properties of the outer layer with the good mechanical properties of the inner core, with the outer layer normally exhibiting worse mechanical properties, i.e., as regards compressibility, due to the addition of metal articles.

Such a gasket is known, for example, from the unexamined European application EP 0 895 49 A2. This publication describes an electrically conductive seal that is produced through coextrusion of a silicon polymer and a silicon polymer with silver components to form a sealing material cord and a conductive medium cord enclosed by the sealing material cord. The outer, electrically conductive cord through the silver components serves to connect electrically conductive casing halves, in whose opening the seal is designed, in order to shield electromagnetic radiation from the casing interior or into the casing interior.

The use of a silicon polymer involves some disadvantages. Silicon is not very compressible, thus, when reducing the size of the casing to be shielded with the consequent corresponding reduction in size of the gasket diameter, good compressibility of the sealing material is required in order to compensate for unevenness on the surfaces of the casing and to ensure that the gasket rests against all the surfaces to be sealed. Furthermore, silicon, which is applied in a viscous state, dries when exposed to air, and continues to harden in the process, is relatively difficult to process and comparatively expensive.

SUMMARY OF THE INVENTION

The present invention provides a gasket which combines sealing materials with various mechanical, chemical, and/or electrical properties that can be produced in a simple manner, and which preferably have good compressibility.

In an embodiment, at least one of the sealing materials has, before it is dispensed, at least two reactive components that react chemically with one another after they are combined and/or the components are dispensed. Polyurethane may be used as a sealing material, consisting of two components that react with one another after they are combined or after being dispensed into the air, and form a sealing foam. The result of the chemical reaction after the curing is a foam gasket that has good compressibility. The two components forming the polyurethane can be easily processed. Thus, these two components, which are suitable for the manufacture of the inner gasket core as well as the outer gasket layer, can be

dispensed or processed in liquid state - and therefore a state that lends itself well to processing - onto the surface to be sealed, while forming a cord, where the two components react with one another and cure. Moreover, polyurethane is reasonably priced.

An advantage of a sealing material that has at least two initial components to be used for at least one of the sealing layers is that the gasket assumes its desired characteristics and cures only after it is put in place through the reaction of at least two components, while the components that have already been mixed but have not yet reacted with one another can be easily worked with and can be dispensed or processed by means of a nozzle. The length of time that the components remain workable without reacting with one another depends on the material. In an embodiment, one can use initial components that react with each other only after they are dispensed into a reaction-promoting atmosphere in a mixed state.

The invention thus provides a versatile co-dispensed gasket and a method for its manufacture, based on the use of a two-component core material setting to an elastomer or foam, to which is applied an outer layer which may be a further two-component material, setting to an elastomer or foam, or a solvent-based coating, either co-dispensed with the core material or applied to the latter subsequently. In this context, "two-component" as applied to the core material, should be construed broadly. The core material must be able to cure or set to a stable final material within the outer layer. This can be achieved with materials not traditionally considered to be two-component materials, as described further below. The core material should have a consistency such that it can be dispensed but will remain *in situ* after dispensing and during curing.

This enables the core and/or the outer layer to be foams as well as elastomers. With a suitable choice of two component compositions or solvent-based coatings, the entire process can be carried out at ambient temperatures. The co-dispensing process can be used to provide form (and foam) in place gaskets, which is not practicable with any known process for two-component gaskets of the types concerned. Rather than forming the gasket *in situ*, it may be co-dispensed into a mould and then cured to provide a desired profile. If low density co-dispensed foams are used, the process is highly cost-effective, while the ability to use foams and/or elastomers with widely different properties makes it very versatile. The use of a mould also means that relatively low viscosity materials may be used, whereas *in situ* formation usually requires the materials to be highly viscous or thixotropic in order that they may remain *in situ* while curing or setting. The core and outer layers may be formed of

different density foams, or the outer layer may be of a material selected to provide a thin, tough flexible skin.

Accordingly, the invention provides a gasket comprising a core formed by a two-component resin which, when set, is at least one of an elastomer and a foam, over which is applied a flexible outer layer of a synthetic resin which, when set, is at least one of an elastomer and a foam.

The invention also includes a method for the manufacture of a gasket according to the invention and an apparatus for the manufacture of a gasket according to the invention.

The apparatus includes two coaxial nozzles, an inner nozzle for the material of the gasket core and an outer nozzle enclosing this inner nozzle for the material of the outer gasket layer. In an embodiment, these nozzles or at least one of these nozzles can be used interchangeably in the nozzle head, as a result of which the diameter and/or the sheathing thickness of the gasket can be varied in a simple manner.

Further features of the invention will be apparent from the following description and examples of embodiments of the invention.

SHORT DESCRIPTION OF THE DRAWINGS

Figure 1 is a cross-section of a gasket according to the invention, the gasket placed on a section of casing;

Figure 2 is a cross-section of a gasket according to the invention, with the gasket compressed in a closed casing;

Figure 3 is a cross-section of a gasket formed in a groove of a casing;

Figure 4 is a section of an apparatus for the manufacture of a gasket according to the invention;

Figure 5 is an enlarged section from Figure 4;

Figure 6 is a schematic diagram of an apparatus for producing gaskets of the invention;

Figure 7 is a fragmentary cross-sectional view of two machine parts, one with a groove to be gasketed with a foam-in-place co-dispensed gasket;

Figure 8 is a cross-sectional view of a mould used to form prefabricated gaskets of the invention;

Figure 9 is a fragmentary cross-sectional view showing an overlap of ends of an extrusion forming a co-dispensed gasket.

Figure 10A to 10D are end views of some different nozzle arrangements that can be utilized in performing the method of the invention.

DESCRIPTION OF EMBODIMENTS

Figure 1 shows a cross-section of a gasket 1 according to the invention, with the gasket placed on a surface 5 of a casing part 6A. The gasket has an inner gasket core 2 and an outer gasket layer 4 that completely encloses the inner gasket core 2 in the embodiment shown. To manufacture the gasket 1, the first, free-flowing sealing material for the gasket core 2, and the second free-flowing sealing material for the outer gasket layer 4, are placed on surface 5 where the sealing materials can cure.

At least one of the two sealing materials has, before being dispensed, at least two components that chemically react with one another after they are combined and/or dispensed into a reaction-promoting atmosphere. Air is a particular example of a reaction-promoting atmosphere, while polyurethane is an example of a sealing material that has at least two components. The components of polyurethane cure after the reaction, while forming a foam that has good compressibility and therefore adjusts well to the contours of the casing to be sealed.

The outer gasket layer 4, which can also consist of a sealing material that has at least two initial components, may be electrically conductive so that it can connect conductively two conductive halves of the casing, 6A, 6B in a closed casing as shown in Figure 2, and consequently so that it can electromagnetically shield the electronic components found in the casing. The material of the outer gasket layer 4 can also be chosen in such a way that it is UV- and/or acid-resistant or has this property in addition to the electric conductivity. The gasket 1 is compressible so that it can fit closed casing 6A, 6B all over the casing halves 6A, 6B and level out unevenness on the sealing surfaces of the casing halves 6A, 6B.

The outer gasket layer 4 may consist of a material that has a closed surface. Sealing foams, such as polyurethane, have pores that liquid can penetrate, and thus may allow the liquid to penetrate the casing to be sealed. In a gasket core 2 having pores, the outer gasket layer 4 therefore may comprise a sealing material that has no pores, for example, silicon. For the outer gasket layer, a sealing material that has at least two initial components that react with one another after they are combined and/or are dispensed while forming an outer gasket layer 4 with a closed surface is also taught.

Figure 3 shows a gasket 1 of the invention, which is formed in a groove 9 of a casing part 7. The groove 9 supports the positioning of the gasket core that is dispensed, with the core being still soft. The disadvantage in placing the sealing materials in a groove 9 is that there can be insufficient ventilation for drying the sealing in the groove 9. As a result, in some sealing materials used for the outer gasket layer 4, no integral skin impermeable to liquid forms on the surface of the outer gasket layer 4 in the area of the groove 9. The risk is that moisture gets through the seal in the area of the groove 9, and in this manner, the moisture penetrates the interior of the casing. To avoid these disadvantages, the outer gasket layer 4 may consist of material which forms an integral skin on the surface even when ventilation is bad during the curing. Such a sealing material can have at least two initial components that react with each other after they are combined or after they are dispensed.

The thickness of the outer gasket layer 4 may be less than the diameter of the gasket core 2. In a seal for electromagnetic shielding of a casing, in which only the outer gasket layer 4 needs to be electrically conductive, one can save on resources such as silver as conductive material.

Of course, the inner gasket core 2 as well as the outer gasket layer 4 can consist of a sealing material that has at least two components that chemically react with one another and cure after they are combined and/or dispensed into a reaction-promoting atmosphere. In the process, electrically conductive particles can be added to the components for the outer layer 4.

The final properties of the gasket 1 will be exhibited only after the reaction of the initial components of the respective gasket layers 2, 4, i.e., the sealing material arises only as a result of the initial components reacting with one another after they are combined and/or dispensed. Depending on the application, there are desired properties of the sealing material

that can be influenced by the selection of the initial components, such as the foaming of the components during the chemical reaction, the formation of a sealing layer with a closed surface, or the curing while an integral skin is formed even when ventilation is not good. Preferred as initial components are liquid components that are easy to work with and can be easily dispensed onto the surface to be sealed before the chemical reaction occurs. Depending on the choice of the initial components, the chemical reaction may take a certain duration after the initial components are combined, and/or it may occur only after the initial components are dispensed into a reaction-promoting atmosphere. The start time of the reaction, or the time period after the time the components to react after they are combined, can be adjusted by selecting the components in such a way that sufficient time remains for dosing the gasket core onto the sealing surface after the initial components react with one another.

One embodiment of the invention provides for the sealing layer to completely enclose the gasket core and to have electrically conductive particles. This embodiment ensures that two conducting halves of the casing are always connected in an electrically conductive manner through the seal, independent of which part of the surface of the seal the casing halves lie against.

A further embodiment provides that the outer gasket layer consists of a material that has a closed surface after the curing.

Silicon is an example of such a material. Sealing materials that have two initial components that chemically react with each other after they are combined and/or dispensed into a reaction-promoting atmosphere in order to form a gasket with a closed surface can also be used. The use of such material prevents moisture from penetrating the pores of the seal, and consequently, the interior of the casing.

Furthermore, it is possible to use for the outer gasket layer a material that exhibits a better resistance against various environmental influences, e.g., the outer gasket layer may have a material resistant to UV-light or acid, in order to adapt the seal to the respective conditions for use.

Sealing materials may be extruded in a viscous state into the grooves of the casings in which they cure in order to form the seal. However, some materials may cure in the groove,

particularly in the groove base, where there is poor ventilation, without forming a so-called integral skin on the scaling surface. The risk is that moisture will penetrate the gasket, and from there, the interior of the casing. The material forming the outer gasket layer is therefore preferably a sealing material that cures even in the grooves, i.e., even when ventilation is not good, while forming an integral skin on the surface. A sealing material that has at least two initial components comes into consideration as sealing material, in which the two components, after being combined or after being dispensed onto the surface to be sealed react with one another and cure, even when ventilation is not good, while forming an integral skin.

Figure 7 is a cross-sectional view of a part 128 with a groove 126 to be gasketed, illustrating one way in which a co-dispensed gasket can be formed-in-place. The cover 130 can be applied after the gasket is formed. The surface of the groove and the composition used for the outer layer will determine whether the outer layer bonds to the surface. The co-dispensed gasket can also be applied on a flat surface rather than in a groove.

Figure 8 is a cross-sectional view of a mould used to shape prefabricated gaskets in accordance with the invention. The gasket is dispensed into the bottom of the mould 132. The cover 134 is applied before the gasket sets. In this case, the outer layer and the mould surface are selected so that the cured gasket will release from the mould surface.

Figure 9 is a longitudinal cross-sectional view of a portion of a co-dispensed gasket in which the beginning and end of the extrusion overlap. This type of overlap is created by starting the dispensing of the outer layer material 136 before starting dispensing of the core material 138, and continuing dispensing of the outer layer material after dispensing of the core material has been stopped. This may be conveniently achieved by using valves 111 and 113 in Figure 6. A continuous, closed-loop gasket is formed if the ends 140 and 142 of the dispensed material are overlapped. An open-ended gasket is formed without the overlap. Gaskets of many sizes and shapes can be made by mounting the nozzle 118 of Figure 6 on a programmable robot.

Figures 10A to 10D are end views of some different nozzle configurations for co-dispensing gaskets in accordance with this invention. It will be noted that the nozzles are not necessarily concentric or of a similar profile, and that the nozzle for the outer layer material may not fully surround that for the core material, providing a gasket in which the core

material is not fully enveloped by the outer layer. This may be necessary or desirable in some applications.

As shown in Figures 10A and 10B, the relative thickness of the outer layer relative to the core layer may vary. It will normally be desirable that the outer layer and core are bonded securely together, and this will be facilitated if both the core and the outer layer are formed by resins of the same general type, e.g., polyurethane.

An apparatus whose nozzle head is shown in Figure 4, and an enlarged partial section of which is in Figure 5, can be used to manufacture a gasket according to the invention.

The nozzle head 10 has a first, continuous borehole 11 leading to a second borehole 12 inclined at an angle against the axis of the first borehole 11. An inner nozzle 13 is inserted into the first borehole 11, the nozzle having a diameter less than the inner diameter of the first borehole 11, so that a ring-shaped passage gap remains free between the exterior circumference of the inner nozzle 13 and interior circumference of the first borehole 11. The inner nozzle 13 is pressed into a first insert 14, which is inserted into the enlarged influx-side and (shown in the upper portion in the figure) of the first borehole 11. The first insert 14 can be inserted in the seat in the nozzle head 10 or can be screwed into it in a detachable manner so that the inner nozzle 13 fitted into the first insert 14 can be interchangeable. On the influx-side end of the first insert 14 and the inner nozzle 13 is inserted a first shutoff valve 15. A feed for the material to the inner gasket core 2 is connected to an influx-side receptacle 16 of the first shutoff nozzle 15. This feed can be formed in a known manner. If the material is a two-component material, the feed consists of a two-component mixing apparatus, in which the two components are mixed and fed through the shutoff valve 15 and the inner nozzle 13.

A second shutoff device, e.g., in the form of a second shutoff valve 17, which can likewise be screwed into the nozzle head 10, is fastened to the influx-side end of the second borehole 12. The second shutoff valve 17 also exhibits a receptacle 16, to which a feed is connected, through which the material of the outer feed is connected, through which the material of the outer gasket layer 4 is fed. Here as well, the feed can be a one-component dosing device or a two-component-mixture and dosing device, as already known in the art. The first borehole 11 is enlarged in its outlet end, shown in the lower portion of the figure. In this enlarged end, a second insert 18 can be inserted, into which an outer nozzle 19 is fit in. The second insert

18 exhibits a continuous borehole into which the outer nozzle 19 has been inserted. The inner diameter of the outer nozzle 19 or the borehole of the second insert is larger than the outer diameter of the inner nozzle 13, as a result of which the ring slot between the first borehole 11 and the inner nozzle 13 in the second insert 18 and the outer nozzle 19 continues. The second insert 18 may be inserted by means of an outside screw into an inner screw of the end-side enlargement of the first borehole 11 so that the second insert 18 can be interchanged with the outer nozzle 19.

For the manufacture of a gasket according to the invention, the first sealing material or initial components of the first sealing material are put in through the first shutoff valve 15 and the second sealing material, or initial components of the second sealing material, through the second shutoff valve 17 of the nozzle head. At least one of the two sealing materials consists of at least two free-flowing components that chemically react with each other after they are combined and/or dispensed into a reaction-promoting atmosphere. The chemical reaction may be, for instance, a sealing foam that has good compressibility arising from the free-flowing components, a sealing material with closed surface, or a sealing material that also ventilates even when ventilation is not good, while forming an integral skin. Electrically conductive particles may be added in the process to the second sealing material or the components.

To extrude the sealing materials, the first sealing material is put under pressure by the first shutoff valve 15 and the inner nozzle 13. Accordingly, the second scaling material, under pressure from the second shutoff valve 17 and the second borehole 12, is pressed into the first borehole 11 and the outer nozzle 19, which enclose the inner nozzle.

The first and second sealing materials are separated from one another in the nozzles 13, 19. They meet each other only at the common outlet end of the inner and outer nozzles 13, 19, where gasket core 2 is formed by the first sealing material. The core comes out of the inner nozzle 13 completely enclosed by an outer gasket layer 4 out of the second sealing material, formed by the outer nozzle 19 and the outer surface of the inner nozzle 13. The sealing materials are chosen such that they do not mix, or mix very little when they meet, but that they nevertheless adhere well to each other.

The nozzle head 10 is fed through the casing part to be sealed so that a viscous gasket core merging from the nozzles is placed directly onto the casing part, and adheres and cures there

in order to form the gasket. The sealing strand may be dispensed onto the casing under an atmosphere that promotes the chemical reaction of at least two components, which comprise at least one of the two sealing materials.

Through the shutoff valves 15 and 17, it is possible to block the feed of the components into the nozzle head 10 at the end of the dosing procedure so that no more component material enters the nozzles and boreholes of the nozzle head 10, preventing a drip of the sealing material at the end of the dosing procedure.

With the apparatus according to Figure 4, a gasket for an electromagnetic shielding can be produced completely out of polyurethane, in which only the outer gasket layer is electrically conductive. For this, the two initial components of polyurethane are fed to the first hollow space and the two initial components made of polyurethane and an electrically conductive material are fed to the second hollow space. After the two sealing materials are dispensed, the components of the polyurethane react, forming a sealing foam in which the outer gasket layer is electrically conductive.

The diameter of the inner gasket core 2 is largely determined by the diameter of the inner nozzle 13 and the thickness of the outer gasket layer 4 is largely determined by the difference between the outer diameter of the inner nozzle 13 and the inner diameter of the outer nozzle 19. By means of the first insert14, the inner nozzle 13 can be changed in order to vary the diameter of the inner gasket core 2. By means of the second insert 18, the outer nozzle 19 can be changed in order to vary the outer diameter of the outer gasket layer 4, and consequently, the entire gasket. The thickness of the outer gasket layer 4 can likewise be varied by exchanging the nozzles 13 and 19.

Figure 6 is a schematic of a dispensing apparatus for producing gaskets using a two-component resin system for the inner core and a two-component resin system for the outer layer. It comprises reservoirs 102, 104, 106 and 108. Reservoirs 102 and 104 hold the two components of the inner core material. Reservoirs 106 and 108 hold the two components of the outer layer material. Metering pumps 102A, 104A, 106A, and 108A dispense correct quantities of each component. The components of the inner core and outer layer are passed through mixers 110 and 112 and shut-off valves 111 and 113 via tubes 142, and are then dispensed through co-axial tubes 114 and 116 of nozzle 118 to form a co-dispensed gasket

120, having a core 127 and an outer layer 124. The resulting gasket will have an elastomeric or foam inner core 127 and an elastomeric or foam outer layer 124.

Although the following examples make use of conventional two-component thermosetting resin systems, the term two-component in the context of the invention should be taken to include systems in which the second component is a gas or simply moisture. A number of moisture-curing foamable compositions are known, and these may be used for the core material, as well as for the outer layer, provided that the moisture required for curing may reach the core. Thus the necessary moisture may be contained in the outer layer material or be produced as a by-product of its curing or may permeate through the outer layer, if the latter is an open cell foam, or the inner core may be moisture-cured by direct application of moisture, if the core is extruded using a nozzle which provides an extrusion in which the core is not fully enveloped by the outer layer. As a further alternative, a second component in the form of a pressurised gas such as nitrogen may be added in the dispensing system to a molten thermoplastic first component. On emerging from the extrusion nozzle, the nitrogen expands to foam the first component which rapidly sets to form a foam. The following examples however make use of conventional two-component core materials.

EXAMPLE 1

A gasket of approximately a half-round cross-section, 8mm in diameter, and having an outer layer 0.5mm thick was formed by co-dispensing of two-component polyurethane foams as follows. An inner core was a two-component, thixotropic material available from Chemque Inc., Indianapolis, Indiana, under the designation CHEM-CAST 624™, the mixing ratio of components A & B of that material being 100 parts to 18.5 part by weight. It cures to a flexible, polyurethane foam with the following properties when cured:

Shore OO Hardness:	45
Compression Deflection:	3.0 psi
Foam Density:	0.3 gm/cm^3

The outer layer was an electrically-conductive thixotropic material available from Chemque Inc. under the designation CHEM-CAST 906™, the mixing ratio of components A & B of that material being 100 to 3.1 parts by weight. The material cures to a flexible polyurethane foam with the following properties:

Shore A Hardness:	10
Compression Deflection:	12.0 psi
Foam Density:	0.6 gm/cm^3
DC Volume Resistivity:	0.10 ohm.cm

The inner core constituted approximately 76% of the total volume. The outer layer constituted approximately 24% of the total volume. The inner core contributed to forming a very soft gasket with good compression recovery, low density and low cost. The outer layer contributed to providing a high electrical conductivity of the finished gasket. The effects of high cost, high hardness and poor compression recovery of the outer layer are minimized by co-dispensing. The overall result was a soft flexible resilient gasket with good conductivity at reasonable cost.

EXAMPLE 2

A gasket was formed of similar dimensions to that of Figure 6, except that the outer layer had a thickness of 0.25mm. In this case, the inner core was formed from CHEM-CAST 624™ mixed as described in Example I to provide a flexible, MDI-based polyurethane foam. This foam has poor UV resistance and outdoor weathering properties:

The outer layer was a white-pigmented, two-component low-viscosity material, available as CHEM-DEC ER96071™ from Chemque Inc., with parts A & B mixed in the ratio of 100 to 110 parts by weight. This cures to a flexible polyurethane elastomer incorporating an aliphatic isocyanate for good UV resistance, and having a Shore A hardness of 50.

The two layers of this gasket were co-dispensed at the same time. The inner core provides a very soft gasket with good compression recovery, low density and low cost, while the outer layer provides good UV and weather resistance and toughness to the gasket.

EXAMPLE 3

A gasket was formed by co-dispensing, having similar dimensions to those of Example 2. The core layer was a two-component thixotropic material available from Chemque Inc. under the designation CHEM-CAST 628-231™, with components A & B mixed in the ratio of 87 to 100 by weight. It cures to a flexible, silicone foam with the following properties:

Shore A Hardness:	15
Compression Deflection:	4.0 psi
Foam Density:	0.45 gm/cm^3

The outer layer was a two-component, electrically conductive, thixotropic material available from Chemque Inc. under the designation CHEM-CAST ER 96088-3™ with components A & B mixed in the ratio 100 to 4.6 by weight. It cures to an electrically-conductive flexible silicone elastomer. It was found that the addition of solvent reduced viscosity for ease of application. As an alternative to co-dispensing, the outer layer may be applied after curing of the inner core layer.

Shore A Hardness:	70
Elastomer Density:	2.9 gm/cm^3
DC Volume Resistivity:	0.15 ohm.cm

The elastomer of the outer skin adds electrical conductivity and toughness to the soft resilient inner foam core.

WE CLAIM:

1. A gasket comprising a gasket core (2) and an outer gasket layer (4) that covers the gasket core (2), in which the gasket core and the outer gasket layer (2, 4) are formed by simultaneously dispensing a first sealing material for the gasket core (2) and a second sealing material for the outer gasket layer (4), characterized in that, before they are dispensed, at least one of the two sealing materials has two reactive components that chemically react with one another when they have been combined and/or dispensed.

2. A gasket according to Claim 1, characterized in that before they are dispensed, both sealing materials have reactive components that chemically react with one another after they are combined and/or dispensed.

3. A gasket according to Claim 1 or 2, characterized in that at least two components react with one another some time after they are combined.

4. A gasket according to any one of claims 1 to 3, characterized in that at least two components react with one another only after they are dispensed into a reaction-promoting atmosphere.

5. A gasket according to any one of claims 1 to 4, characterized in that at least two components react with one another forming a sealing foam.

6. A gasket according to any one of claims 1 to 5, characterized in that said outer gasket layer (4) completely encloses the gasket core (2).

7. A gasket according to any one of claims 1 to 6, characterized in that at least the outer gasket layer (4) has an electrically conductive component, preferably silver.

8. A gasket according to any one of claims 1 to 7, characterized in that the sealing material that has at least two components that react with one another is polyurethane.

9. A gasket according to any one of claims 1 to 8, characterized in that the outer gasket layer (4) has a closed surface.

10. A gasket according to claim 9, characterized in that the outer gasket layer (4) is made of silicon.

11. A gasket (1) comprising a dispensed core (2) formed of a two-component resin which is at least one of an elastomer and a foam, over which is applied a flexible outer layer (3) of a synthetic resin which is at least one of an elastomer and a foam.

12. A gasket according to claim 11, wherein at least the core is of thermosetting resin.

13. A gasket according to claim 11 or 12, wherein the core and outer layer are co-dispensed.

14. A gasket according to any one of claims 11 to 13, wherein the inner core is an elastomeric foam, and the outer layer is also an elastomeric foam.

15. A gasket according to any one of claims 11 to 13, wherein the inner core is an elastomeric foam, and the outer layer is a non-foamed elastomer.

16. A gasket according to any one of claims 11 to 15, wherein the outer layer is an electroconductive elastomer or foam.

17. A gasket according to any one of claims 11 to 16, wherein the outer layer is an ultra-violet resistant elastomer or foam.

18. A gasket according to any one of claims 12, 13, 16 or 17, wherein both the core and outer layers are of elastomeric two-component polyurethane resins.

19. A gasket according to any one of claims 12, 13, 16 or 17, wherein both the core and outer layers are of elastomeric two-component silicone resins.

20. A gasket according to any one of claims 11 to 19, wherein resin used to form the outer layer has conductive particles sufficient to render it conductive.

21. A method for producing a gasket (1) having a core (2) and a surface layer (4), comprising combining components forming a two-component synthetic resin which is at least one of an elastomer and a foam, dispensing said combined components, and applying to said dispensed combined components an outer layer of material forming a flexible synthetic resin which is at least one of an elastomer and a foam.

22. A method according to claim 21, wherein both the core and the outer layer are co-dispensed.

23. A method according to claim 21 or 22, wherein the material of the outer layer contains a solvent.

24. A method according to any one of claims 21 to 23, wherein elastomeric resin used to form the core is foamed during curing.

25. A method according to any one of claims 21 to 23, wherein elastomeric resin used to form the outer layer is unfoamed.

26. A method according to any one of claims 21 to 25, wherein elastomeric resin used to form the outer layer has conductive particles sufficient to render it conductive.

27. A method according to any one of claims 21 to 26, wherein elastomeric resin used to form the outer layer contains a solvent.

28. A method according to any one of claims 21 to 27, wherein components forming at least the core layer interact to form a thermosetting resin.

29. A method according to claim 28, wherein the resin is a polyurethane resin.

30. A method according to claim 28, wherein the resin is a silicone resin.

31. A method for the manufacture of a gasket, comprising a gasket core (2) and an outer gasket layer (4) that at least partially encloses the gasket core (2) are formed by simultaneously dispensing the first sealing material for the gasket core (2) and the

second sealing material for the outer gasket layer (4), in which at least one of the two sealing materials has two reactive components that chemically react with one another after they are combined and/or after they are dispensed.

32. A method according to claim 31, characterized in that before they are dispensed, the two sealing materials have two reactive components that chemically react with one another after they are combined and/or after they are dispensed.

33. A method according to Claim 31 or 32, characterized in that at least two components react with one another some time after they are combined.

34. A method according to any one of claims 31 to 33, characterized in that at least the two components react with one another only after they are dispensed into a reaction-promoting atmosphere.

35. A method according to any one of claims 31 to34, characterized in that the outer gasket layer (4) completely encloses the gasket core (2).

36. A method according to any one of claims 31 to 35, characterized in that at least the outer gasket layer (4) has an electrically conductive component, preferably silver.

37. A method according to any one of claims 31 to 36, characterized in that said sealing material that has at least two components reacting with one another is polyurethane.

38. A method according to any one of claims 31 to 37, characterized in that the outer gasket layer (4) has a closed surface.

39. A method according to any one of Claims 31 to 38, characterized in that the outer gasket layer (4) is made of silicon.

40. An apparatus for the manufacture of a seal comprising:

1. a nozzle head (10);

2. an inner nozzle (13) arranged in the nozzle head (10), for feeding the first sealing material;

3. an outer nozzle (19) arranged in the nozzle head (10), with said nozzle at least partially, coaxially enclosing the inner nozzle (13), for feeding the second sealing material.

41. An apparatus according to Claim 40, characterized in that the inner nozzle (13) is coaxially inserted into the first borehole (11) of the nozzle head (10), in which the inner diameter of the first borehole (11) is larger than the outer diameter of the inner nozzle (13), that a second borehole (12) leads at the side to the first borehole (11), and that the outer nozzle (19) is inserted into the first borehole (11).

42. An apparatus according to Claim 41, characterized in that the inner nozzle (13) is inserted into the first insert (14), and by means of this first insert (14), can be inserted interchangeably from the feeding side into the first borehole (11).

43. An apparatus according to Claim 41 or 22, characterized in that the outer nozzle (19) is inserted into the second insert (18), and by means of this second insert (18), can be inserted interchangeably from the outgoing side into the first borehole (11).

44. An apparatus according to any one of Claim 40 to 43, characterized in that a shutoff device (15, 17) is in each case inserted into a feeding passage of the first sealing material and into a feeding passage of the second sealing material.

Fig. 1

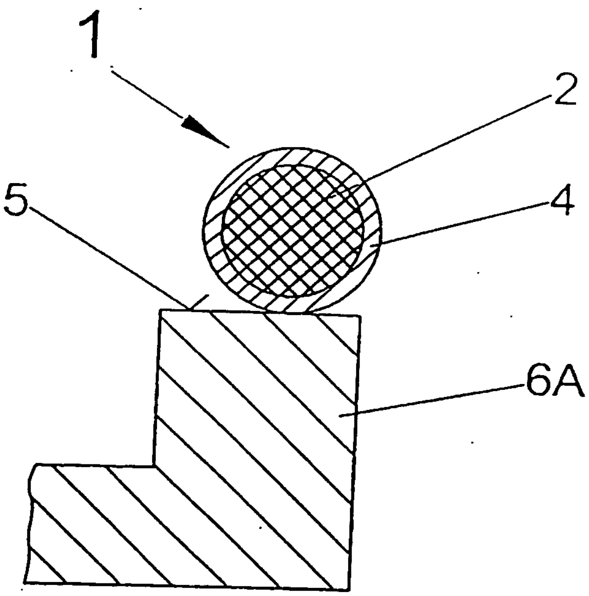


Fig. 2

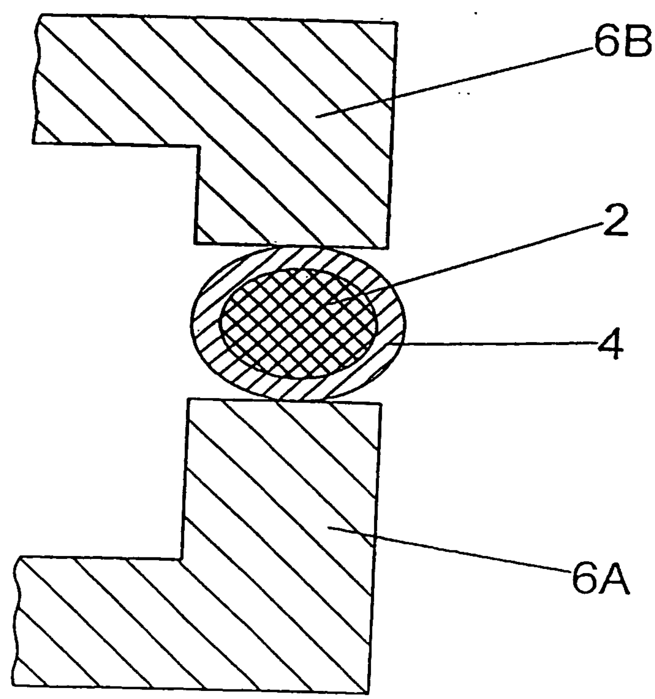


Fig. 3

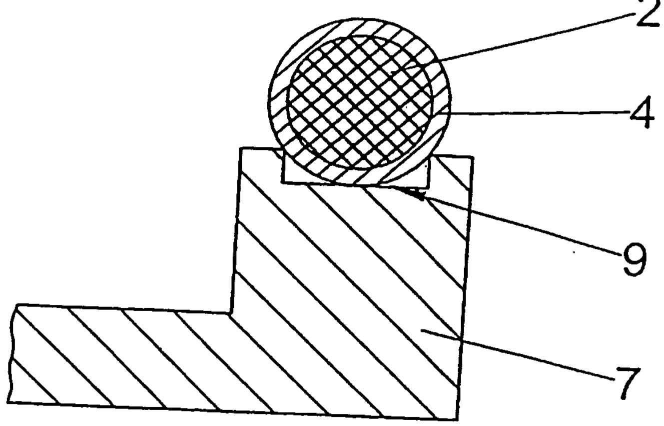


FIG 4

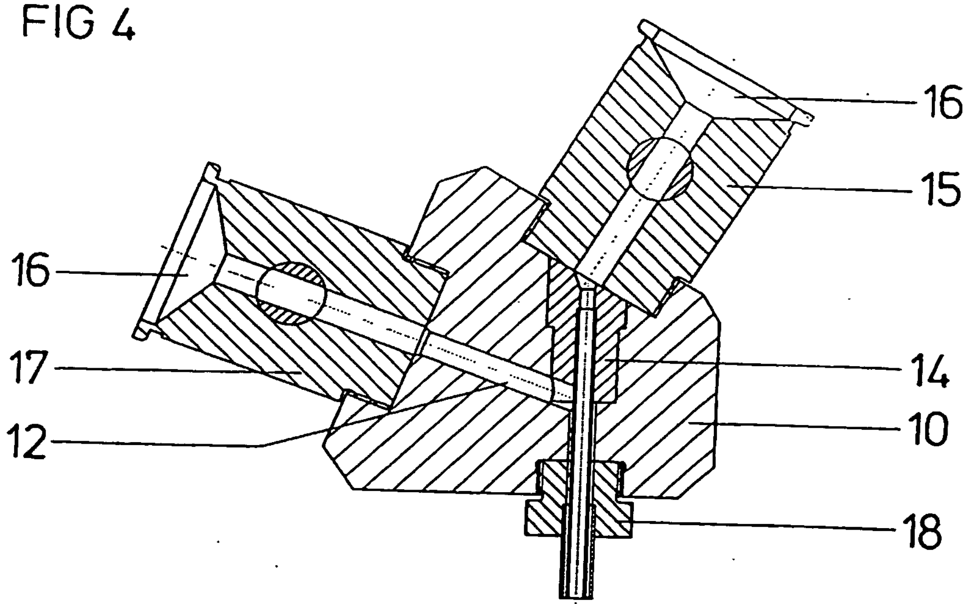
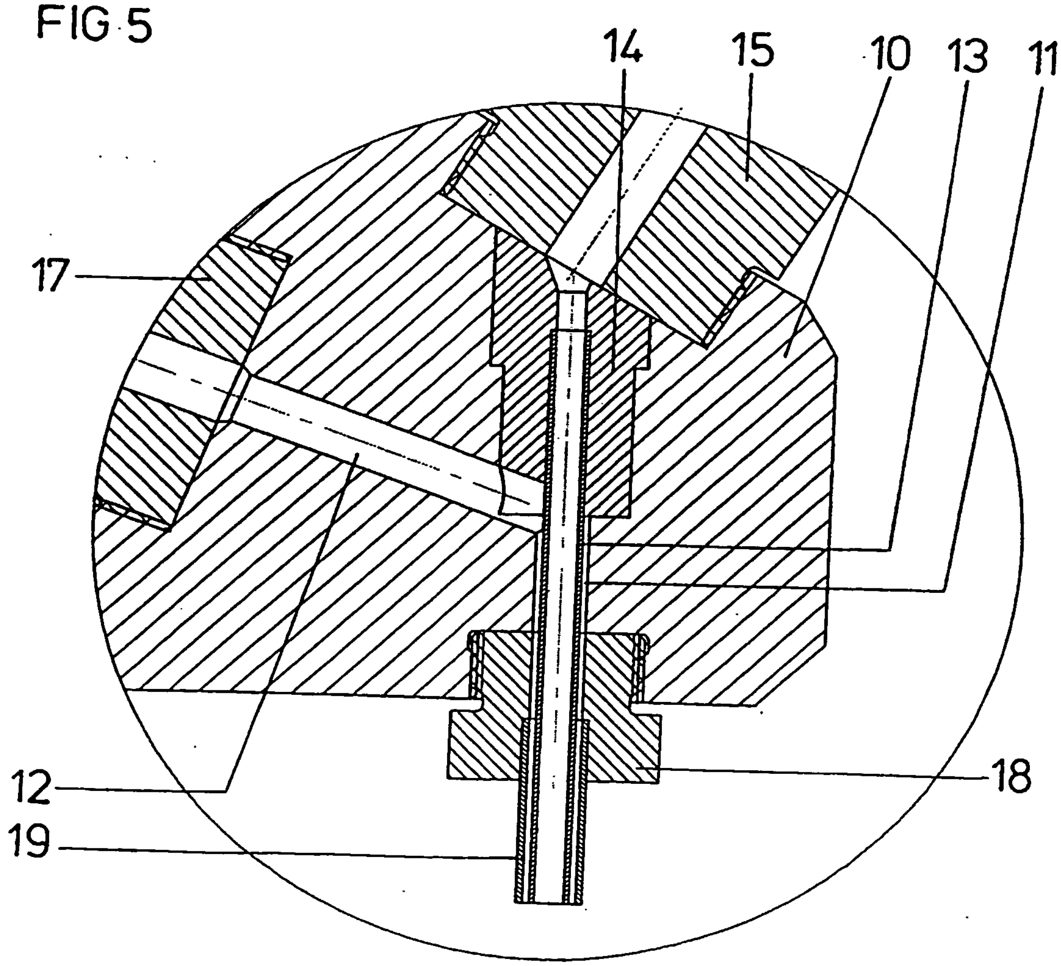


FIG 5



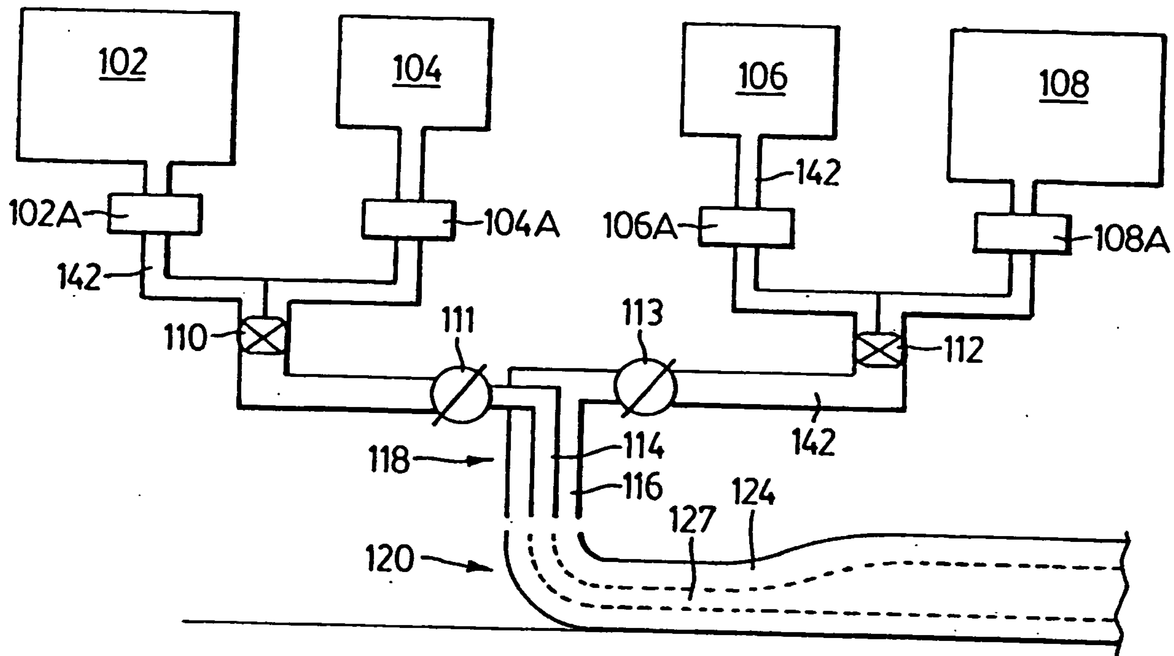


FIG. 6

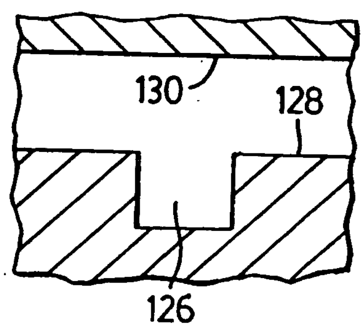


FIG. 7

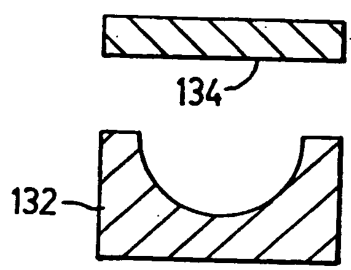


FIG. 8

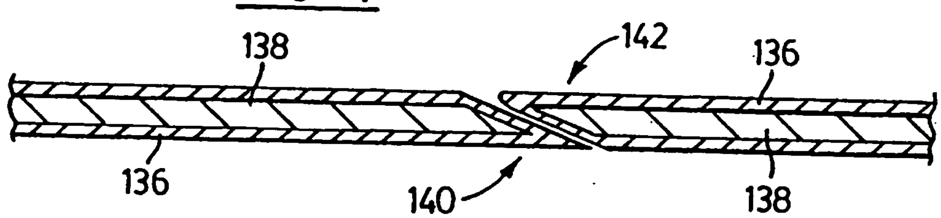


FIG. 9

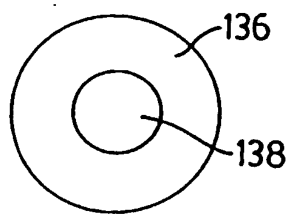


FIG. 10A

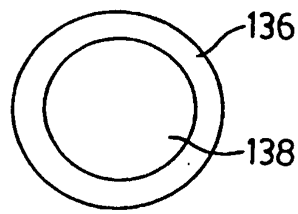


FIG. 10B

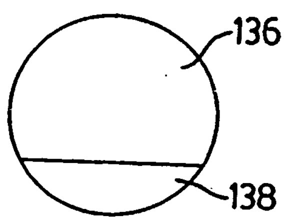


FIG. 10C

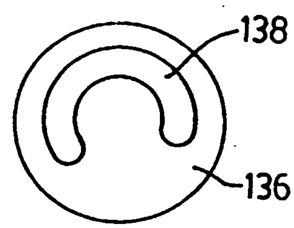


FIG. 10D